



BRIDGE ADVISORY
Construction & Technology Division
Bridge Operations Section

BRIDGE ADVISORY NUMBER: BA-2006-01

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Note: This Bridge Advisory was originally issued as **BITA-2**. It is being re-issued as a Bridge Advisory for cataloging purposes.

SUBJECT: Scour Inspection during Flood Events

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PURPOSE:

Provide guidance for the inspection of scour at bridges and culverts during flood events.

BACKGROUND:

Situation

Scour is typically the removal of the supporting soil structure under and around the sub-structures of bridges and culverts over waterways and is the number one cause of bridge failure/span collapse in the United States. Rapid flow of the water during a flood event can cause scour and in some cases very rapid removal of the supporting soil structure.

Flood events can also wash debris and large trees down stream that can lodge in the narrow opening of the waterway at the bridge. This can accelerate scour and debris can become lodged in the superstructure of the bridge and damage the bearings and other elements. In some cases, the entire superstructure has been moved or completely pushed off the substructure.

Culverts are designed to flow full and withstand a head pressure above the inlet of the structure. This means that the embankment is an important part of the structural system and acts like a dam. Flood conditions can put pressure on the embankments and weakened areas could scour and fail.

Applicability

All bridges and culverts over waterways with supporting elements in the waterway or flood plain are denoted with a "B" or "C" in the bridge number. However, a few structures span over railroads as well as waterways and are designated with "R" in the bridge number.

Special attention must be given to structures that are known to be scour critical, structures that have pre-existing scour holes, and structures that could be over-topped during flood events as well as those that have not been evaluated for scour potential or have unknown foundations.

Preparation – Review of Bridge File

Bridge foundation structures that are on spread footings in granular soils are most susceptible to rapid scour. Review the bridge file, plan sheets for foundation information, and scour evaluation records. Also check the Bridge Safety Inspection Report (BSIR) Pier and Abutment ratings and comments, as well as the Structure Inventory and Appraisal (SI&A) guide Items 61 and 71 (rated 6 and below) and 113 (rated 7 and below) to determine structures with scour potential. The Pontis Smart Flag for Scour (Element #361) will also identify existing scour at a bridge.

INSPECTION AND RECORDING PROCEDURES:

During flood events such as a spring thaw with rapid snowmelt, the waterway can swell to flows many times their usual discharge in both speed and volume. This can create a safety hazard for the bridge inspection team. The flow of water can make it difficult or impossible to enter the waterway and can be un-safe in a boat due to floating debris and strong currents. Banks may also become unstable and give way pulling the inspector into the water. Water temperatures in the early spring can be near the freezing point and the effects of hypothermia can quickly render the inspector/engineer unable to rescue him/herself. Considering all the potential hazards of a flood event, the bridge inspectors/engineers must never put themselves in an unsafe situation.

The Inspection Team Leader must make team members, along with all others at the site, aware of these potential hazards when they are monitoring a situation or flood event.

Procedure

The following guidelines are intended to assist the inspector/engineer and foster awareness of the risks while performing scour inspection during a flood event. The bridge inspector/engineer is likely to be considered the most knowledgeable authority at the site during a flood event. This person will need to set the tone and sense of danger awareness by exercising conservative judgment for the safety of the inspection team.

1. The bridge owner must be aware of structures that are scour susceptible, scour critical, or have a potential for high scour that can lead to loss of sub-structure support.
2. The bridge owner should request a qualified bridge inspector/engineer to visit and evaluate the structure during the flood or shortly thereafter if a more timely visit is not possible.
3. The bridge owner should have a predetermined emergency response/incident management plan that will be activated in the event that a bridge must be closed.
4. The qualified bridge inspector/engineer performing the inspection must exercise sound engineering judgment for the continued use of a structure during the flood event and

- advise the bridge owner accordingly. They should document their observations (preferably with pictures) and state the limitations caused by the conditions at the time of the inspection and affecting their judgment.
5. If, in the judgment of the inspector, action must be taken to close the bridge or limit traffic on portions of the bridge, the inspector is obligated to contact the bridge owner and verbally convey these concerns. If immediate communication with the bridge owner is not possible, the inspector must contact local law enforcement and divert traffic from the structure.
 6. In the case where it is not prudent to directly measure scour with the usual means, the inspector/engineer will record the conditions that can be safely observed or measured at the time and these will be used to guide the inspection when it is safe to enter the waterway.
 7. Every structure that has experienced external forces due to a flood event, regardless of whether the structure is scour critical or susceptible, will have a “Damage Inspection” performed according to the guidelines in “American Association of State Highway and Transportation Officials (AASHTO) Manual for Condition Evaluation of Bridges”. This inspection will take place as soon as possible after flood subsidence and the site is safe for inspection and not more than 30 days from subsidence.
 8. It is important to closely check the structure for misalignment or damage to members after the flood. The level of inspection detail, close-up or routine visual will vary depending on the damage sustained on the structure by the flood.
 9. The Damage Inspection report will be recorded in MBIS and copied to the bridge file.